MITSUBISHI ELECTRIC

Side A JAPANESE
Side B ENGLISH

Programmable Controller
MELSEC iQ-F

MELSEC iQ-F FX5-4AD

Hardware Manual

FX5

Manual Number	IB(NA)-0800574
Revision	G
Date	April 2022

This manual describes the part names, dimensions, installation, and specifications of the product. Before use, read this manual and manuals of relevant products fully to acquire proficiency in handling and operating the product. Make sure to learn all the product information, safety information, and precautions.
And, store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

Registration:
The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies. In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

Effective April 2022
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Safety Precautions (Read these precautions before use.)

This manual classifies the safety precautions into two categories:

⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Depending on the circumstances, procedures indicated by ⚠CAUTION may also cause severe injury.
It is important to follow all precautions for personal safety.

Associated Manual

Manual name	Manual No.	Description
MELSEC iQ-F FX5 User's Manual (Analog Control - Intelligent function module)	SH-081802ENG	Explains analog input module, analog output module, multiple input module.
MELSEC iQ-F FX5S/ FX5UJ/FX5U/FX5UC User's Manual (Hardware)	SH-082452ENG	Describes the details of hardware of the CPU module, including performance specifications, wiring, installation, and maintenance.

How to obtain manuals
For the necessary product manuals or documents, consult with your local Mitsubishi Electric representative.

Applicable standards

FX5-4AD complies with the EC Directive (EMC Directive) , UL standards (UL, cUL) and UKCA marking. Further information can be found in the following manual.
→ **MELSEC iQ-F FX5 User's Manual (Analog Control - Intelligent function module)**
Regarding the standards that relate to the CPU module, please refer to either the product catalog or consult with your local Mitsubishi Electric representative.

Attention
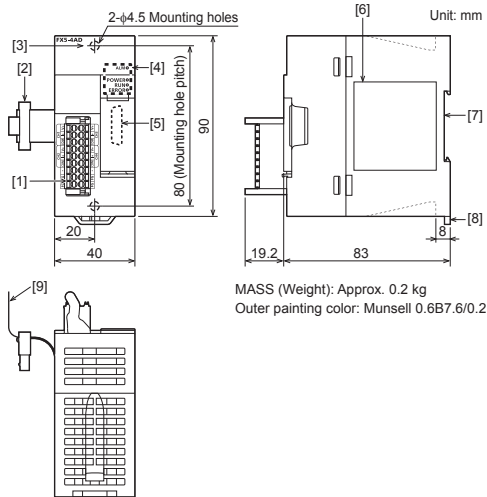This product is designed for use in industrial applications.

1. Outline

FX5-4AD analog input module (hereinafter called FX5-4AD) can convert 4 points of analog input values (voltage input and current input) into digital values.

1.1 Incorporated Items

Check that the following product and items are included in the package:

Product	FX5-4AD analog input module
Included Items	Dust proof protection sheet (1 sheet)
	Hardware manual [Japanese /English] (This manual)
	Hardware manual [Chinese]

1.2 External Dimensions, Part Names

2-ø4.5 Mounting holes
[6]   Unit: mm

80 (Mounting hole pitch)
90
20
40
19.2
83
8

MASS (Weight): Approx. 0.2 kg
Outer painting color: Munsell 0.6B7.6/0.2

[1] Terminal block (Spring clamp terminal block)
[2] Extension cable
[3] Direct mounting hole: 2 holes of ø4.5 (mounting screw: M4 screw)
[4] Operation status display LEDs
[5] Extension connector (for next module)
[6] Name plate
[7] DIN rail mounting groove (DIN rail: DIN 46277, 35 mm wide)
[8] DIN rail mounting hook
[9] Pullout tab

1.3 Indications of LEDs

LED display	LED color	Status	Indication
POWER	Green	On	Power on
		Off	Power off or module failure
RUN	Green	On	Normal operation
		Flashing	Offset/gain setting mode
		Off	Error
ERROR	Red	On	Minor error
		Flashing	Moderate error or major error
		Off	Normal operation
ALM	Red	On	Process alarm or rate alarm issued
		Flashing	Input signal error detected
		Off	Normal operation

1.4 Terminal Layout

CH1 V+ I+ COM
CH2 V+ I+ COM
FG FG

CH3 V+ I+ COM
CH4 V+ I+ COM
FG FG
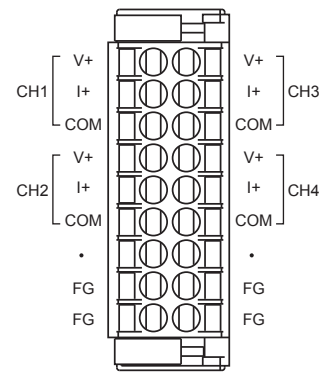
For further information on terminal, refer to the following manual.
→ **MELSEC iQ-F FX5 User's Manual (Analog Control - Intelligent function module)**

2. Installation

INSTALLATION PRECAUTIONS ⚠WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.
- Use the product within the generic environment specifications described in the User's Manual (Hardware) for the CPU module to be used.
  Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl2, H2S, SO2 or NO2), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or rain and wind.
  If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur.

INSTALLATION PRECAUTIONS ⚠CAUTION

- Do not touch the conductive parts of the product directly.
  Doing so may cause device failures or malfunctions.
- When drilling screw holes or wiring, make sure that cutting and wiring debris do not enter the ventilation slits of the PLC.
  Failure to do so may cause fire, equipment failures or malfunctions.
- The dust proof sheet should be affixed to the ventilation slits before installation and wiring work to block foreign objects such as cutting and wiring debris. However, when the installation work is completed, make sure to remove the sheet to provide adequate ventilation.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Install the product on a flat surface.
  If the mounting surface is rough, undue force will be applied to the PC board, thereby causing nonconformities.
- Install the product securely using a DIN rail or mounting screws.
- Connect the extension cables securely to their designated connectors.
  Loose connections may cause malfunctions.

For further information on mounting, refer to the following manual.
→ **MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)**

3. Wiring

WIRING PRECAUTIONS ⚠WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.
- Make sure to properly wire to the spring clamp terminal block in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Twist the ends of stranded wires and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.

WIRING PRECAUTIONS ⚠CAUTION

- Make sure to observe the following precautions in order to prevent any damage to the machinery or accidents due to malfunction of the PLC caused by abnormal data written to the PLC due to the effects of noise:
  - Do not bundle the power line and communication cables together with or lay them close to the main circuit, high-voltage line, load line or power line. As a guideline, lay the power line, control line and communication cables at least 100 mm away from the main circuit, high-voltage line, load line or power line.
  - Ground the shield of the analog input/output cable in accordance with the manuals of each model. However, do not use common grounding with heavy electrical systems.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- To terminal blocks, connect circuits isolated from hazardous voltage by double/reinforced insulation.
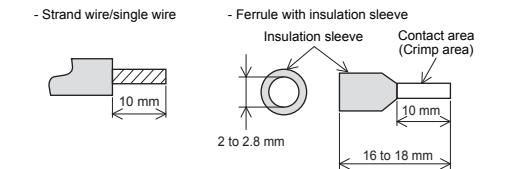
3.1 Applicable Cable
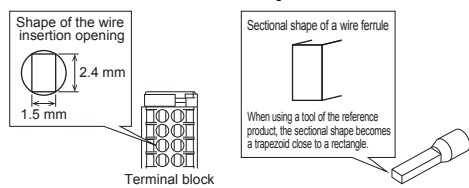
3.1.1 Spring clamp terminal block
1) Suitable wiring

No. of wire per terminal	Single wire, Strand wire (Material: Copper wire)	Ferrules with insulation sleeve	Temperature rating
One wire	AWG24 to 16 (0.2 to 1.5 mm²)	AWG23 to 19 (0.25 to 0.75 mm²)	80℃ or more

2) Wire end treatment
Strip the cable about 10 mm from the tip to connect a wire ferrule at the stripped area. Failure to do so may result in electric shock or short circuit between adjacent terminals because the conductive part. If the wire strip length is too short, it may result in the poor contact to the spring clamp terminal part.
When using a wire ferrule with an insulating sleeve, choose a wire with proper cable sheath referring to the above outside dimensions, otherwise the wire cannot be inserted easily.

- Strand wire/single wire
10 mm

- Ferrule with insulation sleeve
Insulation sleeve   Contact area (Crimp area)
2 to 2.8 mm   10 mm   16 to 18 mm

Check the shape of the wire insertion opening with the following chart, and use the smaller wire ferrule than the described size. Also, insert the wire with care so that the wire ferrule is in proper orientation. Failure to do so may cause the bite of the terminal and the damage of the terminal block.

Shape of the wire insertion opening
2.4 mm
1.5 mm

Sectional shape of a wire ferrule
When using a tool of the reference product, the sectional shape becomes a trapezoid close to a rectangle.

Terminal block

The following table shows wire ferrules and its associated tools compatible with the terminal block. The shape of the wire ferrule differs depending on the crimp tool to be used. Use the reference product. If the product other than referenced products is used, the wire ferrule cannot be removed. Sufficiently confirm that the wire ferrule can be removed before use.
<Reference product>

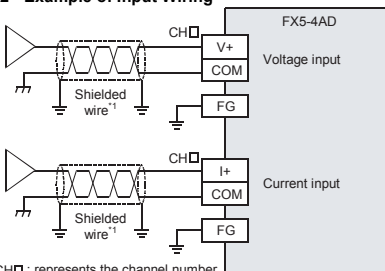| Manufacturer	Model	Wire size	Crimp tool
PHOENIX CONTACT GmbH & Co. KG	AI 0.5-10 WH	0.5 mm²	CRIMPFOX 6
	AI 0.75-10 GY	0.75 mm²	
	A 1.0-10	1.0 mm²	
	A 1.5-10	1.5 mm²	

3) Connecting a cable
- When ferrules with insulation sleeve are used
  Insert a wire with the ferrule with insulation sleeve into the wire insertion opening and push the wire.
- When stranded wires and solid wires are used
  Push the open/close button of the terminal block with a flathead screwdriver. While pushing the open/close button, insert the wire into the insertion opening until the wire reaches the back, and then release the open/close button.
Then, pull the wire lightly and check that it is clamped securely.
<Reference>

Manufacturer	Model name of a flathead screwdriver
PHOENIX CONTACT GmbH & Co. KG	SZS 0.4×2.5 VDE

4) Disconnecting a cable
Push the open/close button of the wire to be disconnected with a flathead screwdriver. Pull out the wire with the open/close button pushed.

3.2 Example of Input Wiring

FX5-4AD
CH□ V+ COM FG   Voltage input
Shielded wire[1]

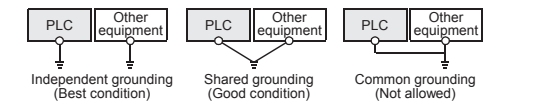CH□ I+ COM FG   Current input
Shielded wire[1]

CH□ : represents the channel number.

[1] For analog input wiring, use shielded twisted-pair cables (double-core type). Separate them from other power lines or lines which are sensitive to induction.

3.3 Grounding

Ground the PLC as stated below.
- Perform class D grounding. (Grounding resistance: 100 Ω or less)
- Ground the PLC independently if possible.
  If the PLC cannot be grounded independently, perform the "Shared grounding" shown below.
  For details, refer to the following manual.
  → **MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)**

PLC | Other equipment   PLC | Other equipment   PLC | Other equipment
Independent grounding (Best condition)   Shared grounding (Good condition)   Common grounding (Not allowed)

- Bring the grounding point close to the PLC as much as possible so that the ground cable can be shortened.

4. Specification

DESIGN PRECAUTIONS ⚠WARNING

- Make sure to set up the following safety circuits outside the PLC to ensure safe system operation even during external power supply problems or PLC failure. Otherwise, malfunctions may cause serious accidents.
  - Most importantly, set up the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
  - Note that when the CPU module detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the CPU module occurs in an input/output control block, output control may be disabled.
    External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.

DESIGN PRECAUTIONS ⚠CAUTION

- Simultaneously turn on and off the power supplies of the CPU module and extension modules.

STARTUP AND MAINTENANCE PRECAUTIONS ⚠CAUTION

- Do not disassemble or modify the PLC.
  Doing so may cause fire, equipment failures, or malfunctions.
  For repair, contact your local Mitsubishi Electric representative.
- Do not drop the product or exert strong impact to it.
  Doing so may cause damage.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.

DISPOSAL PRECAUTIONS ⚠CAUTION

- Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.

TRANSPORTATION PRECAUTIONS ⚠CAUTION

- The product is a precision instrument. During transportation, avoid impacts larger than those specified in the general specifications by using dedicated packaging boxes and shock-absorbing pallets.
  Failure to do so may cause failures in the product. After transportation, verify operation of the product and check for damage of the mounting part, etc.

4.1 Applicable CPU module

Model name	Applicability
FX5UJ CPU module	From first production
FX5U CPU module	Ver. 1.050 or later
FX5UC CPU module[1]	Ver. 1.050 or later

[1] FX5-CNV-IFC or FX5-C1PS-5V is necessary to connect FX5-4AD to the FX5UC CPU module.

4.2 General Specifications

The items other than the following are equivalent to those of the CPU module.
For the general specification, refer to the following manual.
→ **MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)**

Items	Specifications	
Dielectric withstand voltage	500 V AC for 1 minute	Between all terminals and ground terminal
Insulation resistance	10 MΩ or higher by 500 V DC insulation resistance tester	

4.3 Power Supply Specifications

Items		Specifications
Internal power supply	Power supply voltage	24 V DC, 5 V DC
	Current consumption	24 V DC: 40 mA 5 V DC: 100 mA

4.4 Performance Specifications

Items	Specifications
Number of analog input points	4 points (4 channels)
Conversion speed	80 µs/ch
Isolation method	Between input terminal and PLC: Photocoupler Between input terminal and channels: Non-isolation
Number of occupied I/O points	8 points

4.5 Voltage/current input specifications

Items	Specifications		
Analog input voltage	-10 to +10 V DC (input resistance 400 kΩ or more)		
Analog input current	-20 to +20 mA DC (input resistance 250 Ω)		
Digital output value	16-bit signed binary (-32768 to +32767)		
Input characteristics, resolution[1]	Analog input range	Digital output value	Resolution
	Voltage 0 to 10 V	0 to 32000	312.5 µV
	Voltage 0 to 5 V	0 to 32000	156.25 µV
	Voltage 1 to 5 V	0 to 32000	125 µV
	Voltage -10 to +10 V	-32000 to +32000	312.5 µV
	Voltage User range setting	-32000 to +32000	125 µV
	Current 0 to 20 mA	0 to 32000	625 nA
	Current 4 to 20 mA	0 to 32000	500 nA
	Current -20 to +20 mA	-32000 to +32000	625 nA
	Current User range setting	-32000 to +32000	500 nA
Accuracy (accuracy for the full scale digital output value)	Ambient temperature 25±5℃: within ±0.1 % (±64 digit) Ambient temperature 0 to 55℃: within ±0.2 % (±128 digit) Ambient temperature -20 to 0℃: within ±0.3 % (±192 digit)		
Absolute maximum input	Voltage: ±15 V, Current: ±30 mA		

[1] For the input characteristic, refer to the following manual.
→ **MELSEC iQ-F FX5 User's Manual (Analog Control - Intelligent function module)**

⚠ For safe use

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

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